

## **What is claimed is:**

- [Claim 1]** 1. A microfluidic structure comprising:  
a structure defining an input structure for receiving a microfluidic stream, an output structure for transmitting a microfluidic stream, and a space between said input structure and said output structure;  
a colloidal structure located in said space between said input structure and said output structure; and  
means for applying a field to said colloidal structure to manipulate a microfluidic stream between said input structure and said output structure.
- [Claim 2]** 2. A microfluidic structure, as claimed in claim 1, wherein:  
said input structure lies in a first plane;  
said output structure lies in a second plane that is substantially parallel to and separated from said first plane;  
said space comprises a communication path extending between said input structure and said output structure;  
said colloidal structure comprises a colloidal particle.
- [Claim 3]** 3. A microfluidic structure, as claimed in claim 2, wherein:  
said means for applying a field comprises means for applying one of the following: an electric field, a magnetic field, and an optical trap.
- [Claim 4]** 4. A microfluidic structure, as claimed in claim 1, wherein:  
said colloidal structure comprises a string of colloidal particles having a first end that is operatively attached to said structure and a second free end that is capable of rotating about said first end.
- [Claim 5]** 5. A microfluidic structure, as claimed in claim 1, wherein:  
said space comprises a closed loop with a first portion of said closed loop extending along a portion of a straight line extending between said input structure and said output structure and a second portion that does not extend along a straight line between said input structure and said output structure.
- [Claim 6]** 6. A microfluidic structure, as claimed in claim 5, wherein:  
said closed loop has a width that is greater than a width of said output structure.
- [Claim 7]** 7. A microfluidic structure, as claimed in claim 5, wherein:  
said colloidal structure comprises multiple colloidal particles, each located in said closed loop.
- [Claim 8]** 8. A microfluidic structure, as claimed in claim 5, wherein:  
said colloidal structure comprises four colloidal particles, each located in said closed loop.

- [Claim 9]** 9. A microfluidic structure, as claimed in claim 5, wherein:  
said means for applying a field comprises means for applying one of the following: an electric field, a magnetic field, and an optical trap.
- [Claim 10]** 10. A microfluidic structure, as claimed in claim 1, wherein:  
said colloidal structure comprises a string of colloidal particles.
- [Claim 11]** 11. A microfluidic structure, as claimed in claim 10, wherein:  
said means for applying a field includes means for applying one of the following: an electric field, a magnetic field, and an optical trap.
- [Claim 12]** 12. A microfluidic structure, as claimed in claim 1, further comprising:  
a rotatable vane structure having a hub, a first arm extending from said hub, and a second arm extending from said hub, said rotatable vane structure located within said space.
- [Claim 13]** 13. A microfluidic structure, as claimed in claim 12, wherein:  
said colloidal structure comprises a colloidal particle operatively attached to one of said first and second arms of said rotatable vane.
- [Claim 14]** 14. A microfluidic structure, as claimed in claim 12, wherein:  
said means for applying a field comprises pairs of electrodes for producing an electrical field that causes said colloidal particle to move by electrophoresis.
- [Claim 15]** 15. A microfluidic structure, as claimed in claim 12, wherein:  
said colloidal structure comprises a plurality of colloidal particles fixedly located in said structure adjacent to said rotatable vane.
- [Claim 16]** 16. A microfluidic structure, as claimed in claim 12, wherein:  
said means for applying a field comprises means for applying one of the following: an electric field, a magnetic field, and an optical trap.
- [Claim 17]** 17. A microfluidic structure, as claimed in claim 1, wherein:  
said colloidal structure comprises a first pair of colloidal particles for forming a first lobe and a second pair of colloidal particles for forming a second lobe.
- [Claim 18]** 18. A microfluidic structure, as claimed in claim 1, wherein:  
said means for applying a field comprises an optical trap mechanism for use in causing said first lobe to rotate in a clockwise direction and said second lobe to rotate in a counter-clockwise direction.
- [Claim 19]** 19. A photonic structure comprising:  
a structure for confining a plurality of colloidal particles that comprises a first plate and a second plate that is substantially parallel to said first plate and separated from said

first plate by a distance that substantially constrains colloidal particles located between said first and second plates to two-dimensional motion;  
a plurality of colloidal particles located between said first and second plates;  
means for applying a first electrical field to said plurality of colloidal particles, said first electrical field comprising a component that is normal to said first and second plates;  
and  
means for facilitating the entry of light into a space located between said first and second plates.

**[Claim 20]** 20. A photonic structure, as claimed in claim 19, further comprising:

means for preventing said plurality of colloidal particles from occupying a predetermined space between said first and second plates that defines a propagation path for a light signal that is propagating in a direction that is substantially parallel to said first and second plates.

**[Claim 21]** 21. A photonic structure, as claimed in claim 20, wherein:

said means for preventing comprises a wall that is located between said first and second plates and defines said predetermined space by preventing any of said plurality of colloidal particles from existing in a space between said first and second plates that is at least partially occupied by said wall.

**[Claim 22]** 22. A photonic structure, as claimed in claim 21, wherein:

said wall extends from said first plate towards said second plate.

**[Claim 23]** 23. A photonic structure, as claimed in claim 20, wherein:

said means for preventing includes means for producing an optical trap that defines said predetermined space.

**[Claim 24]** 24. A photonic structure, as claimed in claim 20, wherein:

said means for preventing comprises means for applying a second electrical field that extends between said first and second plates and has a greater magnitude than said first electrical field.

**[Claim 25]** 25. A photonic structure, as claimed in claim 19, wherein:

said means for directing comprises means for directing light in a direction that has a component that is normal to a plane occupied by one of said first and second plates.

**[Claim 26]** 26. A photonic structure, as claimed in claim 25, wherein:

said first plate comprises first polarizing filter and said second plate comprises a second polarizing filter that is substantially perpendicular to said first polarizing filter.

**[Claim 27]** 27. A photonic structure comprising:

a structure for confining a plurality of colloidal particles that comprises a first plate, a second plate that is substantially parallel to said first plate and separated from said

first plate by a distance that substantially constrains colloidal particles located between said first and second plates to two-dimensional motion, and a third plate that is substantially parallel to said second plate and separated from said second plate by a distance that substantially constrains colloidal particles located between said second and third plates to two dimensional motion;  
a first plurality of colloidal particles located between said first and second plates of said structure;  
a second plurality of colloidal particles located between said second and third plates of said structure;  
first means for applying a first electrical field that extends between said first and second plates;  
second means for applying a second electrical field that extends between said second and third plates;  
means for facilitating the engagement of light with said structure so that the light has a component that is normal to a plane occupied by one of said first, second and third plates.

**[Claim 28]** 28. A photonic structure, as claimed in claim 27, wherein:

said first plate comprises a first polarizing filter, said second plate comprises a second polarizing filter that is substantially perpendicular to said first polarizing filter, and said third plates comprises a third polarizing filter that is substantially perpendicular to said second polarizing filter.